Commercial Management of ARS Russian Honey Bees

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INTRODUCTION

The Agricultural Research Service (ARS) has a yearly program of releasing different ARS Russian honey bee breeder lines to the beekeeping industry. We have participated in these releases either as breeders, a breeder-queen producer or as cooperators who provide apiaries as test sites for the selection of breeding stock. Several of us have used Russian honey bee stock released by the program to change the honey bee stock in our commercial hives to Russian honey bees. Our experiences have taught us that Russian honey bees have management needs that are somewhat different from the needs of other honey bees, especially Italian honey bees. Here we describe the more important aspects of the commercial management of ARS Russian honey bees.

Springtime Management

Requeening with queens

Requeening non-Russian colonies with Russian queens is more difficult with some stocks than it is with other stocks. Likewise, it is sometimes difficult to requeen a Russian colony with a non-Russian queen. These difficulties are not universal: they seem to be dependent on the specific stock of non-Russian honey bee and probably result from different stocks sometimes having different levels and blends of queen recognition pheromone. However, queen acceptance rates when requeening Russian colonies with Russian queens are rather typical and often reach to the high 90 percentages.

It typically takes longer (up to 10 days) for introduced Russian queens to begin laying eggs. Back checks of queen introductions done on an Italian honey bee schedule are frustrating. Not only are the queens not laying eggs, they are very difficult to find, even if they are paint marked. We have shifted our back check schedules to the 16th day after introduction to accommodate this difference in initiation of egg laying. When Russian queens are laying eggs, they are much easier to find. However, their dark and often striped body color still makes finding Russian honey bee queens difficult. Another normal characteristic of some Russian lines is to maintain "just in case" supersedure cells. This is not a sign of an unsuccessful introduction or failing queen.

Requeening with cells

Requeening with Russian queen cells is similar in many ways to requeening colonies with Russian queens. Cell acceptance appears to be somewhat lower in some but not all domestic stocks and high in Russian colonies. Emerged Russian virgins take more time to become mated egg-laying queens. We have shifted back check schedules for cell introductions to the 20th day after cells are expected to emerge.

Springtime buildup

Some overwintered Russian colonies may have a small cluster size in the early spring. However, even colonies with as few as two to three frames of brood and bees are able to develop into strong colonies that will make a good crop. Both the timing and the speed of the springtime buildup of Russian colonies are notable. The timing is tuned to the availability of pollen. A strong natural pollen flow is necessary to trigger extensive brood nest development. An early spring nectar flow that is unaccompanied by much pollen or feeding with sugar (in whatever form) will not stimulate population development in colonies. However, feeding a combination of pollen or pollen substitute and sugar will cause the colonies to grow. Hence, the early development of strong colonies for pollination, or speciality uses such as queen cell building can be achieved by feeding colonies pollen as well as sugar.

The speed with which Russian colonies will develop in the spring is very surprising. Small colonies develop very quickly. Colonies that are well behind Italian colonies become big colonies in time for the nectar-flow. An important management consideration is to anticipate pollen flows and provide room for brood nest expansion beforehand. Beekeepers, who winter in singles and add their first supers on the bottom, may want to consider adding them on the top. Beekeepers accustomed to managing Italian honey bees will be tempted to underestimate the potential for Russian colonies to rather abruptly shift from small surviving colonies to large colonies needing space to prevent swarming.

Another consideration is that some colonies will be more defensive during the time they are going through the first round of spring brood rearing. They seem to be more protective of the colony and its resources during this critical period. This short period of increased defensiveness should be kept in mind, particularly so that it does not unduly affect the choice of queen mothers for grafting.

Nectar flow management

We have found Russian honey bees to be good honey producers, able to make good crops in good years and excellent crops in excellent years. Putting out honey supers always seems to be a balance between getting some supers on all the colonies to provide at least minimum honey storage and getting enough boxes out on each colony to collect the maximum honey crop. To the degree it is possible, early supering, in particular, should be more liberal than it is with Italian colonies as a way of assuring that management stays ahead of colony needs.

Late Fall and Winter Management

In general, Russian colonies are excellent at overwintering. This begins with their late fall organization of their brood nest. Given a fall flow, they will store pollen covered by sealed honey in an upper

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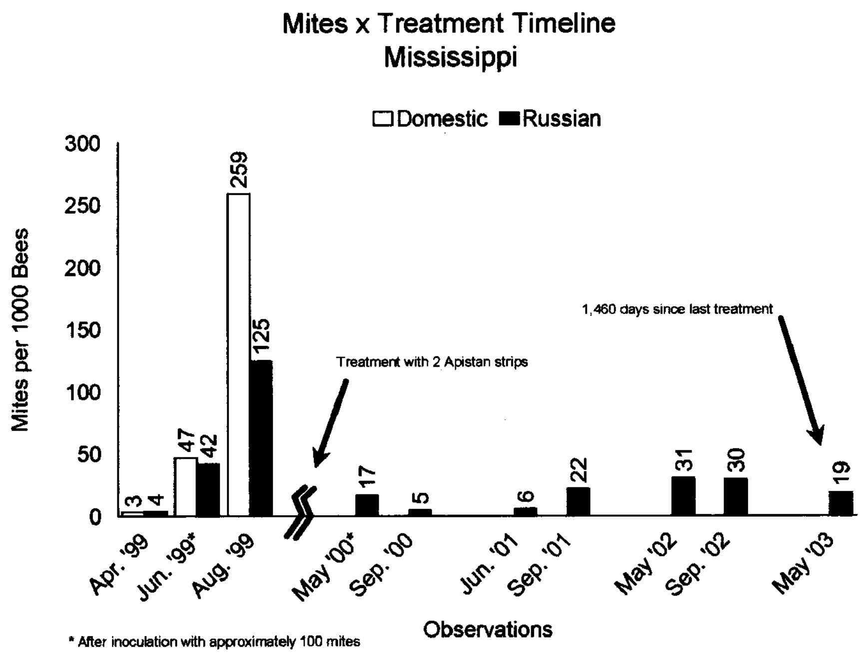
Figure 1. Varroa mite populations over time in colonies at Webb, Mississippi.



food chamber. Honey or feed is stored first in an upper chamber and then to the sides of the lower chamber. Russian bees then cluster below their food and move up only to stay in contact with the food as the season progresses. We have noticed that many Italian colonies cluster at the top of the hive, regardless of food. In a severe winter, Italian bees will become separated from the food and die. This does not happen with Russian colonies. In the winter of 2000-2001, mid-western beekeepers suffered from 30% to 70% losses in their Italian colonies. Russian colonies survived this winter well. In Iowa, we experienced about 10% loss in our Russian colonies, split the overwintering colonies to replace the losses and to make about a 30% actual increase in colony numbers. These splits went on to make an average of 130 pounds of honey that following summer.

All of us have been surprised at how frugal Russian colonies are with winter stores. Colonies always have more food in spring than we are accustomed to seeing with Italian colonies. In Mississippi, many colonies overwinter without using any food from the second story. Next year we will attempt to overwinter some colonies in a single deep hive body. This is already being done with good success in south-central Louisiana.

General Characteristics

Colony defense

Overall, we find that Russian honey bees are quieter and easier to manage, once the colonies have gone through hybrid transitions. Hybrids themselves may be somewhat sting prone. However, after two or three years of requeening with Russian cells, the colonies have bees that are mostly Russian. We have done major apiary management procedures such as making springtime splits or taking honey with minimum protective gear. One of us has the habit of wearing a veil, t-shirt, shorts and shoes while pulling honey in a 3,000 colony operation.

Tracheal mite resistance

For some reason, we do not have problems with tracheal mites in Mississippi, regardless of bee stock. However, the tracheal mite poses a very serious beekeeping problem in northeastern Iowa and can be a serious problem in Louisiana. Loss of colonies and lack of honey production in surviving colonies due to tracheal mite infestation are the biggest concern in Iowa. However, Russian honey bees have excellent tracheal mite resistance: they survive and produce well without treatment for tracheal mites in Iowa conditions that are very favorable for tracheal mites.

Brood nest size

Russian honey bees are very responsive to nectar and pollen flows. They both build-up rapidly when resources are in the field and shut down brood rearing when resources disappear. Because of this characteristic, they will have big colonies during flows but smaller colonies at other times. During a shut-down period the queen reduces or even stops egg-laying. Also, the workers appear to eat back some brood, leaving shot brood patterns in sealed brood. This shot brood pattern disappears when resources return in the field. Large colonies with good brood patterns will shift to small colonies with a shot brood pattern after the main flow. Then, after a summer dearth, the fall flow will cause them to once again develop good brood patterns, become larger, and, if conditions permit, produce a good fall crop.

Honey production

Although some hybrids have reduced honey production, the Russian bees themselves produce very well. All of us have seen crops that average well in excess of 100 pounds. Individual colonies that produce over 200 pounds are common.

Varroa mite resistance

The Russian honey bees are not immune to varroa mites. However, they are resistant to them. Varroa mite populations build up in Russian colonies much more slowly. Also, when Russian colonies become highly infested, they will survive longer and allow more time to treat them. Once treated, they "bounce back" very nicely. We are still learning about how many varroa mite treatments we can skip with Russian bees. It appears that different places will have different answers. Experimental apiaries in Mississippi have entered their fourth year without treatment (Fig.1). However, it may be that the mite resistance of Russian honey bees is enhanced in Mississippi by spring-time broodless periods that are associated with splitting and re-queening. In Louisiana, it is clear that Russian colonies in apiaries that are stocked with only Russian colonies have a slower development of mite populations than Russian colonies in apiaries that also have Italian colonies. Overall, it is clear that Russian colonies require fewer treatments to control varroa mites. However, we need more experience to determine how far we can reduce varroa mite treatments.

Conclusion

We are among the first beekeepers to have Russian honey bees in our beekeeping operations. They are very different bees from the Italian honey bees that we were accustomed to managing. We have needed to adjust our beekeeping practices somewhat to keep Russian honey bees as we learned about them. Probably, we will make still more adjustments in our beekeeping as we learn still more about them. However, the main thing that we have learned is that the Russian honey bee is a good stock that can be managed commercially with much less difficulty than stock we have used in the past.

Although colonies with free-mated SMR queens ought to have fewer varroa mites than colonies with unselected queens, beekeepers should expect some variability in overall level of resitance to varroa. We cannot explain this variability, and there are many possibilities. Whatever the cause, some of our test colonies with free-mated SMR queens were highly resistant to mites and some were susceptible, and a beekeeper won't know which colonies are susceptible and which are resistant unless they check mite levels. Many beekeepers now use simple field techniques to check mite levels in their colonies, and we recommend that this be continued until we can predict mite resistance with more certainty.

We noticed a source of possible confusion when ordering SMR queens from queen breeders. Glenn Apiaries sells SMRxSMR, but also SMR queens crossed with other stocks of bees, and bee breeders are experimenting with various combinations. It is therefore common for a queen breeder to produce queens from SMRxSMR queens as well as from SMR hybrids. When an SMR hybrid is used as a breeder, the daughter queens will have only half of the genes for the SMR trait, and after free-mating with non-SMR drones, her colony may be only 25% SMR; perhaps not enough to have a measurable effect on the mite population. In time, drone populations may have a higher frequency of SMR genes, and the mating of a queen would then contribute more toward increasing mite resistance in a colony.

Future plans

We are in a transition period where most of the honey bees in the USA are still susceptible to varroa, and we want to make them resistant as quickly as possible. Our plan is to add mite-resistant genes to this population of bees without losing the genetic diversity and the beekeeping qualities that we now have. The release of the SMR trait may assist bee breeders in making their bees resistant to mites and may help to increase the frequency of mite-resistant genes in bee populations in many locations around the country.

We are encouraged with the overall performance of SMR queens that are free-mated with unselected drones, but we can do more. We hope to reduce their variability by combining a second mite-resistant trait with the SMR trait. If the addition of another trait increases mite resistance in free-mated queens, it would probably reduce both the variation and the mean rate of growth of mite populations.

The "trait" that we have in mind is a condition in a bee colony that we call "percentage of mites in brood." Our name for the trait describes how we measure it: the percentage of the colony's total mite population that resides in the brood at any time, as long as all stages of brood are present in ample quantity.

We assume that all mites in a colony are either in a brood cell or on adult bees, so we measure those two subpopulations in each colony and add them to get a total mite population (immature and adult *progeny* in brood cells are not counted). Over the years, we have found, on average, that about 65% of the mites are in brood cells. Colonies with a low percentage of mites in brood have a mite population that tends to remain on adult bees rather than entering brood cells where they would reproduce. By remaining on adult bees, mites delay their opportunity to reproduce, thereby reducing their rate of population growth.

We have been measuring the percentage of mites in brood for as long as we have been working with the SMR trait (about 7 years), but we are only beginning to use it in breeding. This trait should complement the SMR trait because it affects mites while they are outside rather than inside a

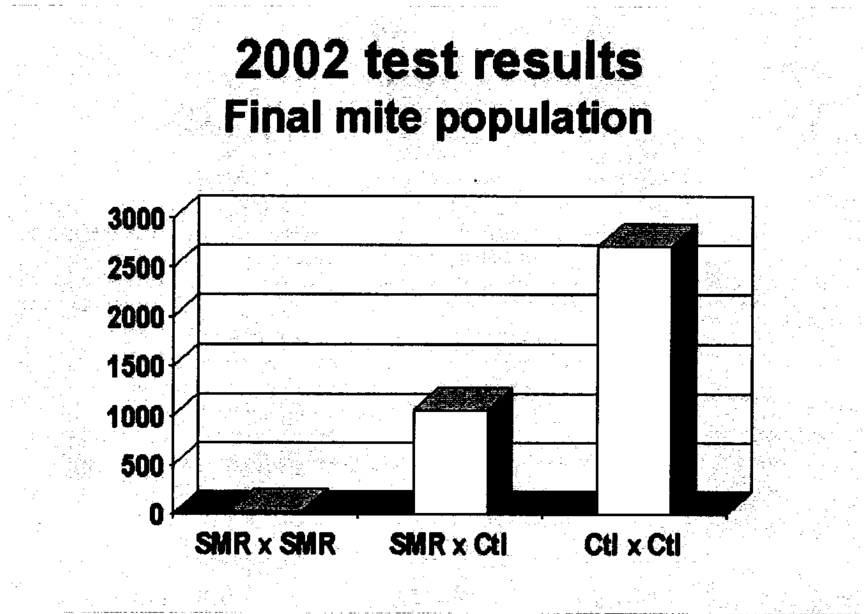


Fig. 2. Test results from 24 colonies described in Table 1 plus five SMRxSMR colonies that were included in the test to serve as a baseline for mite growth. As in the earlier test[2], colonies with SMRxSMR queens excelled in mite resistance, but were sub par in bee population (those 5 colonies averaged 36 mites and 2.5 pounds of bees per colony at the end of the 137-day test period).

A mite family as seen at the beginning of the 15th day of bee development. The four mite progeny are: (1) egg [below mother mite], (2) female deutonymph [lower left of mother mite], (3) male deutonymph [immediately above mother mite] and (4) a female protonymph [farthest above and to left of mother mite].

A mite family as seen on the 17-18th day of the bee's development. The family consists of the mother mite, and her adult son and adult daughter (both located the farthest above the mother mite). The remaining two progeny are female deutonymphs.